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Research Note

A Comparison of the Helminth Fauna of Two *Plethodon cinereus* Populations

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ABSTRACT: Two populations of *Plethodon cinereus* were examined for gastrointestinal helminths. The Pennsylvania population harbored 2 species, the cestode *Cylindrotaenia idahoensis* and the nematode *Batracholandros magnavulvaris*, and the Virginia population harbored 2 species, the trematode *Brachycoelium obesum* and the nematode *Cosmocercoides variabilis*. The presence of *Cylindrotaenia idahoensis* and *Cosmocercoides variabilis* in *Plethodon cinereus* establishes new host records. Pennsylvania is a new locality record for *Batracholandros magnavulvaris* and *Cylindrotaenia idahoensis*.

KEY WORDS: Caudata, *Plethodon cinereus*, Trematoda, *Brachycoelium obesum*, Cestoda, *Cylindrotaenia*

idahoensis, Nematoda, *Batracholandros magnavulvaris*, *Cosmocercoides variabilis*.

The red-backed and lead-backed salamander, *Plethodon cinereus* (Green, 1818) Baird, 1850, is a small terrestrial salamander inhabiting forest-floor litter in cool, mesic coniferous and hardwood forests; it is found from southern Labrador and the Maritime Provinces of Canada to North Carolina, Indiana, and Minnesota (Smith, 1963). Some natural history of this salamander was pre-

Table 1. Helminths reported from *Plethodon cinereus* from various North American localities.

Helminth	Prevalence	Abundance	Mean intensity (range)	Locality	Reference
Trematoda					
<i>Brachycoelium salamandrae</i>	—*	50	—	Giles Co., VA	Cheng, 1958
	3.4	—	—	Durham Co., NC	Rankin, 1937a
	47.9	—	2.14	NC	Rankin, 1937a
	—	—	—	Avery Co., NC	Rankin, 1938
	25% (9/35)	—	—	Western MA	Rankin, 1945
	3% (1/36)	—	3.0	South-central NY	Fischthal, 1955a
	21% (5/24)	16	3.2	Pike Co., PA	Fischthal, 1955b
	57% (8/14)	8	1.0	WI	Coggins and Sajdak, 1982
	15% (26/171)	—	2.9 (1-16)	Barry Co., MI	Muzzall, 1990
<i>Brachycoelium louisianai</i>	—	21	—	VA	Cheng, 1960
<i>Brachycoelium obesum</i>	—	—	—	Giles Co., VA	Cheng, 1958
	—	>350	—	Giles and Albmarle cos., VA; Chester Co., PA	Cheng, 1960
<i>Brachycoelium storeriae</i>	22% (13/60)	62	4.8 (1-38)	Accomack Co., VA	This study
	—	4	—	Giles Co., VA	Cheng, 1958
	100% (4/4)	4	1.0	Bucks Co., PA	Cheng and Chase, 1960
Cestoda					
Plerocercoids	8.3	—	—	Durham Co., NC	Rankin, 1937a
<i>Cylindrotaenia americana</i>	12% (2/17)	—	—	Washington Co., TN	Dunbar and Moore, 1979
<i>Cylindrotaenia idahoensis</i>	7% (3/45)	17	5.6 (1-10)	Mercer Co., PA	This study
Nematoda					
<i>Angiostoma plethodontis</i>	—	—	—	VA	Chitwood, 1933
<i>Batracholandros magnavulvaris</i>	2.08	—	0.02	Buncombe Co., NC	Rankin, 1937b
	50% (6/12)	—	1.5 (1-12)	Fairfax Co., VA	Ernst, 1974
	28% (48/171)	—	1.9 (1-7)	Barry Co., MI	Muzzall, 1990
	9% (4/45)	7	1.8 (1-3)	Mercer Co., PA	This study
<i>Cosmocercoides dukae</i>	3.4	—	—	Durham Co., NC	Rankin, 1937a
	8% (3/35)	—	—	Western MA	Rankin, 1945
	7% (1/14)	1	1.0	WI	Coggins and Sajdak, 1982
<i>Cosmocercoides variabilis</i>	22% (13/60)	27	2.0 (1-4)	Accomack Co., VA	This study
<i>Oswaldocruzia pipiens</i>	3% (1/35)	—	—	Western MA	Rankin, 1945
<i>Rhabdias ranae</i>	7% (1/14)	—	—	WI	Coggins and Sajdak, 1982
Unidentified	25% (3/12)	—	1.3 (1-2)	Fairfax Co., VA	Ernst, 1974

* Not given.

sented by Dunn (1926); information on its parasites has been published by Chitwood (1933), Rankin (1937a, b, 1945), Fischthal (1955a, b), Ernst (1974), Dunbar and Moore (1979), Coggins and Sajdak (1982), and Muzzall (1990) (Table 1). This report compares the helminth fauna of 2 populations of *P. cinereus*.

Sixty *Plethodon cinereus* were collected by hand at Wallops Station, Accomack County, Virginia (30°57'N, 75°24'W), May 1992, from under logs in a pine-oak forest; 45 were collected from Buhl Ravine, Mercer County, Pennsylvania (41°12'N,

80°30'W), September 1991, from under rocks in an oak-maple forest. Both color phases (red-backed and lead-backed) were present in each sample. Salamanders were sacrificed by intra-peritoneal injection of 70% ethanol and fixed in 5% formalin, washed in water, then transferred to 70% ethanol for storage. The body cavity was opened by a longitudinal incision from vent to throat, and the gastrointestinal tract was excised by cutting across the esophagus and rectum. The stomach and small and large intestines were slit longitudinally and examined under a dissecting

microscope. Each helminth was examined and identified using a glycerol wet mount. Selected cestodes were stained with hematoxylin and mounted in Canada balsam. Representative specimens were placed in vials of ethanol and deposited in the U.S. National Parasite Collection, Beltsville, Maryland 20705 (*Brachycoelium obesum*, 84389; *Cosmoceroides variabilis*, 84390; *Cylindrotaenia idahoensis*, 84391; *Batracholadros magnavulvaris*, 84392). Terminology use is in accordance with Margolis et al. (1982).

Six of 45 (13%) salamanders from Pennsylvania harbored helminths: 3 (7%) had a total of 17 individuals of the cestode species *Cylindrotaenia idahoensis* (Waitz and Mehra, 1961) Jones, 1987; 4 (9%) had a total of 7 individuals, 3 male, 4 female, of the nematode species *Batracholadros magnavulvaris* (Rankin, 1937) Petter and Quentin, 1976; and 1 salamander (2%) had a dual infection. Twenty-four of 60 (40%) salamanders from Virginia harbored helminths: 13 (22%) had a total of 62 individuals of the trematode species *Brachycoelium obesum* Cheng, 1958; 13 (22%) had a total of 27 individuals, 3 male, 24 female, of the nematode species *Cosmoceroides variabilis* (Harwood, 1930) Travassos, 1931; and 2 salamanders (3%) had dual infections.

The only trematode species found in this study was *Brachycoelium obesum*, which occurred in the small intestine of salamanders from Virginia. Although this trematode ranged from 1 to 38 individuals per infected host, only 5 hosts had 2 or more parasites. There has been controversy surrounding the assignment of species to the genus *Brachycoelium*. Rankin (1938) reduced all the American species to synonymy with *Brachycoelium salamandrae*, a European species and the type species; however, Parker (1941) and Cheng (1958) did not accept the synonymy and recognized 7 and 10 species, respectively. Later, Cheng and Chase (1960) and Couch (1966) described additional species to bring to 13 the number of species assigned to the genus. The specimens collected in this study most closely resemble *B. obesum* as described by Cheng (1958); they are oval distomes, rounded anteriorly, and less than 1.10 mm long with a large cirrus sac extending across the acetabulum. *Brachycoelium obesum* has also been found in *Ambystoma opacum* from West Virginia (Joy and Mills, 1975); *Desmognathus fuscus* from Illinois (Dyer et al., 1980) and Georgia (Byrd, 1937; Parker, 1941); *Eurycea bislineata* and *Plethodon glutinosus* from Georgia (Parker, 1941); and *P. glutinosus* from

eastern Pennsylvania (Cheng, 1960), South Carolina (Byrd, 1937), and Virginia (Cheng, 1958, 1960). Infection requires ingestion of appropriate intermediate hosts. Both the common land snail *Zonatoides ligerus* and the common slug *Agriolimax agrestris* are suspected to be intermediate hosts (Cheng, 1960).

The only cestode found in this study was *Cylindrotaenia idahoensis*, which was collected from the small intestine of salamanders from Pennsylvania. This finding represents new locality and host records. Jones (1987) introduced some uncertainty in the host lists for species of *Cylindrotaenia* with his revision of the genus: *C. americana*, frequently reported in species of *Desmognathus* and *Plethodon* (Mann, 1932; Dunbar and Moore, 1979; Goater et al., 1987; McAllister et al., 1993), is considered to be a parasite of anurans, whereas *C. idahoensis*, originally described from *Plethodon idahoensis* by Waitz and Mehra (1961) and also known from *P. vehiculum* in Oregon (Panitz, 1969), is suggested to be the representative species in caudata. Dyer (1983) recorded *C. americana* from *Plethodon jordani* in North Carolina; but when Jones (1987) reexamined the material from *P. jordani*, it was determined to belong to *C. idahoensis*. Specimens collected in this study had paruterine complexes in a longitudinal orientation, a characteristic of *C. idahoensis*; in *C. americana*, the paruterine complexes have a transverse or diagonal orientation.

Two nematode species were found, 1 in salamanders from Virginia and 1 in salamanders from Pennsylvania. *Batracholadros magnavulvaris* was originally described as *Oxyuris magnavulvaris* by Rankin (1937b), who had a large number of female oxyurids from salamanders collected in North Carolina. Schad (1960) assigned *Oxyuris magnavulvaris* to the genus *Thelandros* and later described the male (Schad, 1963). Petter and Quentin (1976) expanded the genus *Batracholadros* to include species parasitic in American amphibians previously attributed to the genus *Thelandros*. *Batracholadros magnavulvaris* has been reported from a variety of salamanders (see Muzzall, 1990; Muzzall and Schinderle, 1992; Joy et al., 1993). *Batracholadros magnavulvaris* was found only in the Pennsylvania population, which represents a new locality record.

As in the cases of identity of species of *Brachycoelium* and *Cylindrotaenia*, some uncertainty exists for species of *Cosmoceroides*. *Cosmoceroides variabilis* was first described as *Ox-*

ysomatium variabilis by Harwood (1930) from *Bufo valliceps* from Houston, Texas, as well as a number of other species of amphibians and reptiles. *Cosmocercoides dukae* was first described as *Cosmocerca dukae* by Holl (1928) from *Triturus viridisens* from North Carolina. Wilkie (1930) established the genus *Cosmocercoides*, and Travassos (1931) included both *C. dukae* and *C. variabilis* in his monograph on the Cosmocercidae. Harwood (1932) synonymized *O. variabilis* with *Cosmocercoides dukae* and expressed some dismay that Travassos (1931) had the impression that Harwood (1930) had included a number of species in his original discussion of *Oxysomatium variabilis*. The major difference in the 2 species was the number of rosette papillae: *C. dukae* with 12 pairs of rosette papillae, and *C. variabilis* with 14–20 pairs. *Cosmocercoides dukae* is considered to be a parasite of terrestrial molluscs with inadvertent occurrence in animals feeding upon terrestrial molluscs; *C. variabilis* is considered to be a parasite of amphibians (see Vanderburgh and Anderson, 1987). Each male specimen in this study possessed 19 pairs of rosette papillae, thus the designation *Cosmocercoides variabilis*. This species was found only in the Virginia population and represents a new host record.

This is the first study of red-backed salamanders from western Pennsylvania: Mercer County is in the Ohio River drainage system. The 2 populations studied here harbor different helminth species. The results of this study are similar to those in other parasitologic surveys of *Plethodon cinereus* in that the number of parasite species found is low and the number of salamanders infected is also low. Not enough information is yet available to make any generalizations about the distribution patterns of the helminths of *P. cinereus*.

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